2700 MISSION ROAD, COURTENAY
CIVIL ENGINEERING ACCESS & SITE SERVICING REPORT

1.0 INTRODUCTION

The intent of this Site Servicing Report is to identify any possible issues related to servicing this site and to suggest appropriate approaches for the design of this development. The project is located at 2700 Mission Road. The proposed development consists of a three-lot subdivision. Lot 1 and Lot 3 will each have a new apartment building and the Lot 2 will consist of 6 new townhouses. This report will supersede the previous report was submitted June 23, 2020.

Lot 1	BC Housing	40-Unit Apartment Building
Lot 2	Group A	5-Unit Townhouse
	Group B	5-Unit Townhouse
	Group C	5-Unit Townhouse
	Group D	5-Unit Townhouse
	Group E	4-Unit Townhouse
	Group F	4-Unit Townhouse
Lot 3	Rental Apartment	36-Unit Apartment Building

Figure 1: Existing Site – 2700 Mission Road
Credit: Courtenay Map

2.0 ROADS AND ACCESS

The current property is currently accessed via Mission Road at Madrona Place. This access will remain with an additional right-in right-out access from Veterans Memorial Parkway (VMP).

Mission Road is classified as a Collector Road and is located in a 20m wide right-of-way. The pavement is approximately 11.5m wide, with concrete curb and gutter on both sides. There is a 1.5m wide sidewalk on the south side of Mission Road. There are existing lease-lights on the utility poles on the north side of Mission Road. There will be a 1.5m wide sidewalk added behind the existing curb along the frontage of mission road. The existing driveway letdown will be removed and replaced with curb and sidewalk.

VMP is classified as at Major Arterial Road and located in a 25m wide right-of-way. The pavement is approximately 20m wide, with a ditch and lease lights along the east side. The road appears to need upgrades along the frontage to meet City of Courtenay standards, including curb and gutter, paint separated bike lane and 1.5m wide sidewalk.

The sidewalk along VMP will be extended as a multi-use gravel trail along the north side of the property and connect to the existing Cascara Trail on the North corner of the property.

3.0 WATERMAINS

There is an existing 250Ø watermain along VMP, we propose to make 2 connections, one to Lot 1 via a 200Ø PVC and the second to Lot 3 via 100Ø PVC

There is an existing 200Ø PVC watermain along Mission Road, we propose to connect this 200Ø PVC watermain via a 200Ø PVC service to Lot 2.

There is an existing service connection to the existing building which will be capped and abandoned when the building is removed.

From a fire flow perspective, all eight buildings will be considered separately. Preliminary FUS calculations for the entire site require the following fire flows (see attached):

Lot	Building	Required Fire Flows (L/s)
Lot 1	BC Housing	200
Lot 2	Group A	100
	Group B	117
	Group C	117
	Group D	100
	Group E	100
	Group F	100
Lot 3	36 Unit Apartment Building	183

There are 2 existing hydrants on Mission Road. Additionally, one new hydrant along VMP (near the secondary entrance) and two new private on-site hydrants will be installed in Lot 1 and Lot 2.

The water meter for each lot will be located a chamber at property line. To address the cross connect backflow preventers to located after water meters. The final size of the service and metering will be determined through detailed design and coordination with the mechanical consultant.

4.0 SANITARY SEWER

It is proposed to connect Lot 1 and Lot 3 to the existing 200Ø sanitary sewer along VMP via separate 200Ø PVC services. Lot 2 to be connected to the existing 200Ø sanitary sewer along Mission Road via a 200Ø PVC service.

Technical Memorandum (2020-063-COU) prepared by GeoAdvice on October 13, 2020 for the City of Courtenay indicated there were 4 areas downstream of the development that caused deficiencies in the sanitary system. This was based on sanitary loads provided in Herold Engineering's *Civil Site Servicing Report* date June 6, 2020. The changes in lot sizes and unit counts have reduced the sanitary loads but likely has not changed those area of deficiency but it is recommended this be confirmed with GeoAdvice. Herold Engineering provided the City of Courtenay with our Opinion of Probable Cost (December 1, 2020) for upgrades to address the deficiencies.

Preliminary sanitary flow calculations with each lot calculated separately (see attached).

Lot	Description	Units	Flow (l/s)
Lot 1	BC Housing Family	40	1.24
Lot 2	Market Townhomes	28	0.94
Lot 3	Rental Building	36	1.13

The final servicing option will be determined through detailed design and coordination with the mechanical consultant.

5.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

The following stormwater management plan was created based on the Design Guideline Manual of the Master Municipal Construction Documents and City of Courtenay Supplementary Design Guidelines. Additionally, the "Stormwater Source Control Design Guidelines 2012" (SSCDG) were consulted for stormwater management best practices. For the purpose of this stormwater plan the entire site (all 3 lots) will be considered as one lot. A summary of the proposed site drainage and stormwater management plan is as follows (see attached calculations):

1. The overall site is 2.37ha in size, and slopes from southeast to northwest. There is an existing 300Ø PVC storm service to property line from Mission Road at Madrona Place. This storm sewer leads to a 525Ø PVC storm sewer along VMP which increases to a 600Ø PVC storm sewer. We propose to install a second 450Ø PVC storm service from the 600Ø PVC storm sewer along VMP.

2. Based on knowledge of the surrounding area there is a dense glacial till 0.5m to 1.5m below the existing grade. As such the site is not expected to be conducive to stormwater infiltration systems.

3. The majority of stormwater that lands on the impermeable surfaces (building roofs/asphalt) will be directed via overland flow and roof leaders to the swale system. Due to the subgrade conditions noted in point #2, the system will not be designed to infiltrate into the existing subgrade. The stormwater will be detained in the soil structure, of landscaped areas and surface ponding within the swale.

4. The swale will direct the stormwater to a detention pond at the west side on the property via surface flow and there will also be a perforated pipe under-drain to ensure that the system remains effective.

5. The detention pond which will be sized to detain a 100-year event in Courtenay. For this site, preliminary calculations indicate required storage volume is 110m³.

6. The detention pond will outlet into an orifice-control manhole that regulates the outflow to the pre-development flow rate, which for this site is 149.0L/s. The manhole outlet will connect to the existing 600Ø storm sewer on VMP via a new 450Ø storm service. There will also be an overflow to accommodate larger rainfall events greater than a 100-year event which will be directed overland towards VMP.

7. The majority of the overland flow from the paved parking areas will flow through the planted swale. According to SSCDG, "Infiltration of stormwater through healthy soil is generally agreed to one of the most effective practices to improve water quality and remove urban pollutants."

8. Currently, overland flow greater than a 100-year rainfall event would travel northwest towards VMP. The development would not significantly alter this path.

The final layout and details will be determined through detailed design and coordination with the architect and landscape architect.

6.0 EROSION AND SEDIMENT CONTROL

An Erosion and Sediment Control plan meeting current City and Environment requirements will be prepared and submitted with the application for Building Permit.

7.0 CONCLUSION

The design of the civil works associated with this project will be consistent with the Design Guideline Manual of the Master Municipal Construction Documents and City of Courtenay Supplementary Design Guidelines and aligned with the overall project goals of functionality, practicality, and sustainability.

Submitted by:

HEROLD ENGINEERING LIMITED

Prepared by:

Jeffery Van Tol, EIT

Reviewed by:

Patrick Ryan, P.Eng.

3701 Shenton Road
Nanaimo, BC V9T 2H1
Ph: 250-751-8558 Fax: 250-751-8559

HEROLD ENGINEERING

Fire Underwriter's Survey
Fire Flow Estimate Summary

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

PROJECT No.: 5166-001/03
DATE: 31/03/2021

FIRE AREA CONSIDERED	LOT	TOTAL AREA m²	SPRINKLERED	FIRE FLOW (L/MIN)	FIRE FLOW (L/SEC)
40 Unit BC Housing Building	Lot 1	3,600	Y	12,000	200
36 Unit Rental Building	Lot 3	2,900	Y	11,000	183
GROUP A - 5 Unit Townhouse	Lot 2	690	Y	6,000	100
GROUP B - 5 Unit Townhouse		690	Y	7,000	117
GROUP C - 5 Unit Townhouse		690	Y	7,000	117
GROUP D - 5 Unit Townhouse		690	Y	6,000	100
GROUP E - 4 Unit Townhouse		552	Y	6,000	100
GROUP F - 4 Unit Townhouse		552	Y	6,000	100

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 1

FIRE AREA CONSIDERED

40 UNIT BC HOUSING APARTMENT BUILDING

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		1,200	NO. OF STORIES		3
TOTAL FLOOR AREA (m^2)		3,600			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE					20000 L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-5000 L/Min.
			SUB-TOTAL		15000 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-7500 L/Min.
			SUB-TOTAL		7500 L/Min. c

EXPOSURES	DISTANCE			
FRONT	26	m	ADD	10%
LEFT	60	m	ADD	0%
REAR	12	m	ADD	15%
RIGHT	33	m	ADD	5%
			TOTAL	30%

Note:
1. Front is Building A
2. Left to VMP
3. Rear to VMP & ARL
4. Right to PL

USE	30% x b	4500	L/Min. d
TOTAL	c + d	12000	L/Min.
FIRE FLOW REQUIRED		12000	L/Min.
	or	**200**	**L/sec.**

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 3

FIRE AREA CONSIDERED

36 UNIT RENTAL APARTMENT BUILDING

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		754	NO. OF STORIES		4
TOTAL FLOOR AREA (m^2)		2,900			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE					18000 L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-4500 L/Min.
			SUB-TOTAL		13500 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-6750 L/Min.
			SUB-TOTAL		6750 L/Min. c

EXPOSURES	DISTANCE			
FRONT	28	m	ADD	10%
LEFT	14	m	ADD	15%
REAR	60	m	ADD	0%
RIGHT	29	m	ADD	10%
			TOTAL	35%

Note:
1. Front is Building A & B
2. Left to Building E
3. Rear to VMP
4. Right to Building B

USE	35% x b	4725 L/Min.	d
TOTAL	c + d	11475 L/Min.	
FIRE FLOW REQUIRED		11000 L/Min.	
	or	**183 L/sec.**	

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group A - 5 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		339	NO. OF STORIES		2
SECOND FLOOR AREA (m^2)		351			
TOTAL FLOOR AREA (m^2)		690			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE				9000 L/min.	a
OCCUPANCY	Residential Low Hazard		ADD OR SUBTRACT	-25% x a	-2250 L/Min.
			SUB-TOTAL		6750 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-3375 L/Min.
			SUB-TOTAL		3375 L/Min. c

EXPOSURES	DISTANCE			
FRONT	20	m	ADD	15%
LEFT	27	m	ADD	10%
REAR	55	m	ADD	0%
RIGHT	12	m	ADD	15%
			TOTAL	40%

Note:
1. Front is Building D
2. Left to Building A
3. Rear to Building B
4. Right to Setback

USE	40% x b	2700 L/Min.	d
TOTAL	c + d	6075 L/Min.	
FIRE FLOW REQUIRED		6000 L/Min.	
	or	**100 L/sec.**	

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group B - 5 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		339	NO. OF STORIES		2
SECOND FLOOR AREA (m^2)		351			
TOTAL FLOOR AREA (m^2)		690			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE					9000 L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-2250 L/Min.
			SUB-TOTAL		6750 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-3375 L/Min.
			SUB-TOTAL		3375 L/Min. c

EXPOSURES	DISTANCE				
FRONT	20	m	ADD	15%	
LEFT	12	m	ADD	15%	
REAR	12	m	ADD	15%	
RIGHT	27	m	ADD	10%	
			TOTAL	55%	
			USE	55% x b	3713 L/Min. d
			TOTAL	c + d	7088 L/Min.
			FIRE FLOW REQUIRED		7000 L/Min.
				or	**117 L/sec.**

Note:
1. Front is Building C
2. Left to Setback
3. Rear to Building E
4. Right to Building A

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group C - 5 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION	Wood Frame		
MAIN FLOOR AREA (m^2)	339	NO. OF STORIES	2
SECOND FLOOR AREA (m^2)	351		
TOTAL FLOOR AREA (m^2)	690		
CONSTRUCTION COEFFICIENT	1.5	Wood Frame	F=220CVA

FIRE FLOW FROM TABLE				9000 L/min.	a
OCCUPANCY	Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-2250 L/Min.	
		SUB-TOTAL		6750 L/Min.	b
AUTOMATIC SPRINKLERS (Y/N)	Y	SUBTRACT	-50% x b	-3375 L/Min.	
		SUB-TOTAL		3375 L/Min.	c

EXPOSURES	DISTANCE			
FRONT	20	m	ADD	15%
LEFT	27	m	ADD	10%
REAR	12	m	ADD	15%
RIGHT	12	m	ADD	15%
			TOTAL	55%

Note:
1. Front is Building F
2. Left to Building A
3. Rear to Building D
4. Right to Setback

USE	55% x b	3713 L/Min.	d	
TOTAL	c + d	7088 L/Min.		
FIRE FLOW REQUIRED		7000 L/Min.		
	or	**117 L/sec.**		

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group D - 5 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		339	NO. OF STORIES		2
SECOND FLOOR AREA (m^2)		351			
TOTAL FLOOR AREA (m^2)		690			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE					9000 L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-2250 L/Min.
			SUB-TOTAL		6750 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-3375 L/Min.
			SUB-TOTAL		3375 L/Min. c

EXPOSURES	DISTANCE			
FRONT	20	m	ADD	15%
LEFT	12	m	ADD	15%
REAR	50	m	ADD	0%
RIGHT	27	m	ADD	10%
			TOTAL	40%

Note:
1. Front is Building E
2. Left to Building A
3. Rear to Across Mission Road
4. Right to Setback

USE	40% x b	2700	L/Min. d
TOTAL	c + d	6075	L/Min.
FIRE FLOW REQUIRED		6000	L/Min.
	or	**100**	**L/sec.**

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group E - 4 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION		Wood Frame			
MAIN FLOOR AREA (m^2)		271	NO. OF STORIES		2
SECOND FLOOR AREA (m^2)		281			
TOTAL FLOOR AREA (m^2)		552			
CONSTRUCTION COEFFICIENT		1.5	Wood Frame		F=220CVA
FIRE FLOW FROM TABLE					8000 L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-2000 L/Min.
			SUB-TOTAL		6000 L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-3000 L/Min.
			SUB-TOTAL		3000 L/Min. c

EXPOSURES	DISTANCE			
FRONT	18	m	ADD	15%
LEFT	60	m	ADD	0%
REAR	14	m	ADD	15%
RIGHT	15	m	ADD	15%
			TOTAL	45%

Note:
1. Front is Group F
2. Left to Mission Road
3. Rear to Building A
4. Right to Group c

USE	45% x b	2700 L/Min.	d
TOTAL	c + d	5700 L/Min.	
FIRE FLOW REQUIRED		6000 L/Min.	
	or	**100 L/sec.**	

FIRE UNDERWRITER'S SURVEY
FIRE FLOW ESTIMATE

CITY	Courtenay	DATE	March 30, 2021
		ENGINEER	Jeffery Van Tol, EIT
		CHECKED BY	Patrick Ryan, P.Eng

ADDRESS (NAME OF OCCUPANT IF PROMINENT)

2700 Mission Road
Courtenay, BC
Lot 2

FIRE AREA CONSIDERED

Group F - 4 TOWNHOUSE UNITS

TYPES OF CONSTRUCTION		Wood Frame		
MAIN FLOOR AREA (m^2)		271	NO. OF STORIES	2
SECOND FLOOR AREA (m^2)		281		
TOTAL FLOOR AREA (m^2)		552		
CONSTRUCTION COEFFICIENT		1.5	Wood Frame	F=220CVA

FIRE FLOW FROM TABLE					8000	L/min. a
OCCUPANCY		Residential Low Hazard	ADD OR SUBTRACT	-25% x a	-2000	L/Min.
			SUB-TOTAL		6000	L/Min. b
AUTOMATIC SPRINKLERS	(Y/N)	Y	SUBTRACT	-50% x b	-3000	L/Min.
			SUB-TOTAL		3000	L/Min. c

EXPOSURES	DISTANCE			
FRONT	18	m	ADD	15%
LEFT	15	m	ADD	15%
REAR	7.5	m	ADD	20%
RIGHT	60	m	ADD	0%
			TOTAL	50%

Note:
1. Front is Group E
2. Left to Group D
3. Rear to Mission Road
4. Right to VMP

USE	50% x b	3000	L/Min.	d
TOTAL	c + d	6000	L/Min.	
FIRE FLOW REQUIRED		6000	L/Min.	
	or	**100**	**L/sec.**	

HEROLD ENGINEERING

SANITARY SEWER FLOW ANALYSIS CALCULATION SHEET

PROJECT NAME: 2700 Mission Road, Courtenay
PROJECT LOCATION: 2700 Mission Road
DESIGNED BY: Jeffery Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001
DATE: 24/03/2021

								Sewage Flow		Infiltration & Inflow		
Area	Location	Area (Ha)	Unit or Lots	Density ppu	Equiv. Pop. (ca)	Average Flow (L/day/ca)	Peaking Factor (PF)	Peak Flow (L/day)	Peak Flow (L/sec)	Infilt. (L/s/ha)	Infilt. (L/sec)	**Total Flow (L/sec)**
Lot 1	BC Housing Family	0.702	40	1.7	68	360	4.24	103884	1.202	0.060	0.042	**1.24**
Lot 2	Market Townhouses	1.045	28	1.7	47.6	360	4.41	75494	0.874	0.060	0.063	**0.94**
Lot 3	Rental Building	0.628	36	1.7	61.2	360	4.29	94536	1.094	0.060	0.038	**1.13**

Note:
1. Lot 1 & Lot 3 connecting to service on Veteran's Memorial Parkway
2. Lot 2 connecting to service on Mission Road

$$PF = \frac{3.2}{P^{0.105}}$$

p= Population in 1000's

HEROLD ENGINEERING

Stormwater Management Summary Sheet

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

Predevelopment Area	C	Area (m²)	Area (ha)
Forested	0.25	23746	2.37
N/A	0.00	0	0.00
Total Average	**0.25**	**23746**	**2.37**

Post Development Area	C	Area (m²)	Area (ha)
Building Area	0.90	4782	0.48
Asphalt Parking Lot	0.90	6426	0.64
Landscaping	0.25	12538	1.25
N/A	0.00	0	0.00
N/A	0.00	0	0.00
Total Average	**0.56**	**23746**	**2.37**

IDF Curve	Courtenay Puntledge BCHP

Results Summary		
Total Detention Volume (m³)	110	
Pre-Development Flow Rate (L/s)	149	
Orifice Diameter (mm)	192	100-Year

Pages Following:

- 2-Year Detention Calculations
- 5-Year Detention Calculations
- 10-Year Detention Calculations
- 25-Year Detention Calculations
- 100-Year Detention Calculations
- Orifice Calculations

3701 Shenton Road, Nanaimo, BC V9T 2H1 Telephone: 250-751-8558 email: mail@heroldengineering.cor

HEROLD ENGINEERING

Stormwater Management
2-Year Detention Calculations

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

IDF Curve	Courtenay Puntledge BCHP	2-year

Time of Concentration (min)	
t_c (Pre)	10
t_c (Post)	10

$R=A*t_c^B$	
A_2=	11
B_2=	-0.386

Predevelopment Area	C	Area (m³)	Area (ha)	Flow (L/s)
Forested	0.25	23746	2.3746	36.25
N/A	0.00	8874	0	0.00
Total Average	0.25	23746	2.3746	36.25

Post Development Area	C	Area (m³)	Area (ha)	Flow
Building Area	0.90	4782	0.4782	26.28
Asphalt Parking Lot	0.90	6426	0.6426	35.32
Landscaping	0.25	12538	1.2538	19.14
N/A	0.00	0	0	0.00
N/A	0.00	0	0	0.00
Total Average	0.56	23746	2.3746	80.74

Duration (hr)	I (mm/hr)	Inflow (L/s)	Total Inflow Volume over Duration (L)	Total Allowable Outflow Volume over Duration (L)	Storage Required (m^3)
0.083	29	105.51	31653	10876	20.78
0.100	27	98.34	35402	13051	22.35
0.117	25	92.66	38916	15226	23.69
0.167	22	80.74	48444	21751	26.69
0.250	19	69.04	62139	32627	29.51
0.500	14	52.84	95103	65254	29.85
0.750	12	45.18	121987	97881	24.11
1.000	11	40.43	145555	130508	15.05

Maximum Storage Required (m³)	**29.85**

HEROLD ENGINEERING

Stormwater Management
5-Year Detention Calculations

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

IDF Curve	Courtenay Puntledge BCHP	5-year

Time of Concentration (min)	
t_c (Pre)	10
t_c (Post)	10

$R=A*t_c^B$	
A_2=	17.5
B_2=	-0.452

Predevelopment Area	C	Area (m³)	Area (ha)	Flow (L/s)
Forested	0.25	23746	2.3746	64.91
N/A	0.00	8874	0	0.00
Total Average	0.25	23746	2.3746	64.91

Post Development Area	C	Area (m³)	Area (ha)	Flow
Building Area	0.90	4782	0.4782	47.06
Asphalt Parking Lot	0.90	6426	0.6426	63.24
Landscaping	0.25	12538	1.2538	34.27
N/A	0.00	0	0	0.00
N/A	0.00	0	0	0.00
Total Average	0.56	23746	2.3746	144.58

Duration (hr)	I (mm/hr)	Inflow (L/s)	Total Inflow Volume over Duration (L)	Total Allowable Outflow Volume over Duration (L)	Storage Required (m^3)
0.083	54	197.77	59331	19474	39.86
0.100	50	182.13	65565	23369	42.20
0.117	46	169.87	71344	27264	44.08
0.167	39	144.58	86745	38948	47.80
0.250	33	120.37	108329	58423	49.91
0.500	24	87.99	158383	116845	41.54
0.750	20	73.26	197791	175268	22.52
1.000	18	64.32	231565	233690	-2.13

Maximum Storage Required (m³)	**49.91**

HEROLD ENGINEERING

Stormwater Management
10-Year Detention Calculations

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

IDF Curve	Courtenay Puntledge BCHP	10-year

Time of Concentration (min)	
t_c (Pre)	10
t_c (Post)	10

$R=A*t_c^B$	
A_2=	21.9
B_2=	-0.477

Predevelopment Area	C	Area (m³)	Area (ha)	Flow (L/s)
Forested	0.25	23746	2.3746	84.96
N/A	0.00	8874	0	0.00
Total Average	0.25	23746	2.3746	84.96

Post Development Area	C	Area (m³)	Area (ha)	Flow
Building Area	0.90	4782	0.4782	61.59
Asphalt Parking Lot	0.90	6426	0.6426	82.77
Landscaping	0.25	12538	1.2538	44.86
N/A	0.00	0	0	0.00
N/A	0.00	0	0	0.00
Total Average	0.56	23746	2.3746	189.21

Duration (hr)	I (mm/hr)	Inflow (L/s)	Total Inflow Volume over Duration (L)	Total Allowable Outflow Volume over Duration (L)	Storage Required (m^3)
0.083	72	263.36	79007	25487	53.52
0.100	66	241.42	86912	30584	56.33
0.117	61	224.31	94209	35682	58.53
0.167	51	189.21	113529	50974	62.55
0.250	42	155.94	140346	76461	63.89
0.500	30	112.04	201669	152922	48.75
0.750	25	92.34	249308	229383	19.92
1.000	22	80.50	289787	305844	-16.06

Maximum Storage Required (m³)	**63.89**

HEROLD ENGINEERING

Stormwater Management
25-Year Detention Calculations

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

IDF Curve	Courtenay Puntledge BCHP	25-year

Time of Concentration (min)	
t_c (Pre)	10
t_c (Post)	10

$R=A*t_c^B$	
A_2=	27.3
B_2=	-0.499

Predevelopment Area	C	Area (m³)	Area (ha)	Flow (L/s)
Forested	0.25	23746	2.3746	110.16
N/A	0.00	8874	0	0.00
Total Average	0.25	23746	2.3746	110.16

Post Development Area	C	Area (m³)	Area (ha)	Flow
Building Area	0.90	4782	0.4782	79.87
Asphalt Parking Lot	0.90	6426	0.6426	107.32
Landscaping	0.25	12538	1.2538	58.17
N/A	0.00	0	0	0.00
N/A	0.00	0	0	0.00
Total Average	0.56	23746	2.3746	245.35

Duration (hr)	I (mm/hr)	Inflow (L/s)	Total Inflow Volume over Duration (L)	Total Allowable Outflow Volume over Duration (L)	Storage Required (m^3)
0.083	94	346.74	104023	33049	70.97
0.100	86	316.59	113972	39659	74.31
0.117	80	293.15	123123	46268	76.85
0.167	67	245.35	147212	66098	81.11
0.250	55	200.41	180370	99147	81.22
0.500	39	141.81	255259	198293	56.97
0.750	32	115.83	312754	297440	15.31
1.000	27	100.34	361241	396586	-35.35

Maximum Storage Required (m³)	**81.22**

HEROLD ENGINEERING

Stormwater Management
100-Year Detention Calculations

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

IDF Curve	Courtenay Puntledge BCHP	100-year

Time of Concentration (min)	
t_c (Pre)	10
t_c (Post)	10

$R=A*t_c^B$	
A_2=	35.5
B_2=	-0.521

Predevelopment Area	C	Area (m³)	Area (ha)	Flow (L/s)
Forested	0.25	23746	2.3746	149.01
N/A	0.00	8874	0	0.00
Total Average	0.25	23746	2.3746	149.01

Post Development Area	C	Area (m³)	Area (ha)	Flow
Building Area	0.90	4782	0.4782	108.03
Asphalt Parking Lot	0.90	6426	0.6426	145.17
Landscaping	0.25	12538	1.2538	78.68
N/A	0.00	0	0	0.00
N/A	0.00	0	0	0.00
Total Average	0.56	23746	2.3746	331.88

Duration (hr)	I (mm/hr)	Inflow (L/s)	Total Inflow Volume over Duration (L)	Total Allowable Outflow Volume over Duration (L)	Storage Required (m^3)
0.083	130	476.23	142868	44704	98.16
0.100	118	433.07	155906	53644	102.26
0.117	109	399.65	167854	62585	105.27
0.167	90	331.88	199126	89407	109.72
0.250	73	268.68	241811	134111	107.70
0.500	51	187.24	337031	268221	68.81
0.750	41	151.58	409277	402332	6.95
1.000	36	130.48	469746	536442	-66.70

Maximum Storage Required (m³)	**109.72**

HEROLD ENGINEERING

Stormwater Management
Orifice

PROJECT NAME: Mission Road Affordable Housing
PROJECT LOCATION: 2700 Mission Road, Courtenay
DESIGNED BY: Jeff Van Tol, EIT
REVIEWED BY: Patrick Ryan, P.Eng.

HEL PROJECT No.: 5116-001/03
DATE: 30/03/2021

Orifice Equation: $Q = CA(2gh)^{0.5}$

Q = Allowable release rate (m^3/s)
C = Orifice coefficient (0.62 for sharp or square edge)
A = Area of orifice (m^2)
g = Gravity ($9.81 m/s^2$)
h = Net head on orifice (m) from design drawings

Event	Flow, Q (L/s)	C	h	Area (m²)	Orifice Diameter (mm)
2-year	36.3	0.62	1.93	0.0095	110.0
5-year	64.9	0.62	1.93	0.0170	147.2
10-year	85.0	0.62	1.93	0.0223	168.4
25-year	110.2	0.62	1.93	0.0289	191.7
100-year	149.0	0.62	1.93	0.0391	223.0

Note: Orifice located inside flow control manhole